Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Please cancel claims 1-117.

Please add the following new claims

118.   (New) A method executed in a computer system for producing a model of a combined physical system having physical quantities by representing physical quantities of the combined system in terms of partial differential equations, said method comprising:

representing each of a plurality of systems as an application mode modeling physical quantities of said each system;

determining a representation of a partial differential equation for each application mode corresponding to one of said plurality of systems using at least one non-local coupling, said at least one non-local coupling determining a value in at least one portion of a domain depending on a value from at least one other portion of a domain, parameters of the partial differential equations being physical quantities of corresponding ones of said plurality of systems; and

outputting a model of the combined physical system using the partial differential equations corresponding to said plurality of systems, whereby the model represents a mathematical expression of the physical quantities of the combined physical system.

119.   (New) The method of Claim 118 wherein said non-local coupling defines a value from a first domain in a first geometry to another domain in a second geometry.

120.   (New) The method of Claim 119, further comprising: forming, for each of said first and second geometries, a system of partial differential equations each having associated coupling variables.

121.   (New) The method of Claim 119, wherein at least one of said partial differential equation systems uses at least one local coupling.

122.   (New) The method of Claim 119, wherein said first and second geometries are the same.

123.   (New) The method of Claim 119, wherein said first and second geometries are different.

124.   (New) The method of Claim 118, further comprising:

defining a non-local coupling wherein a value of a quantity on a boundary of a first domain is referenced on parallel lines extending into said first domain.

125.   (New) The method of Claim 119, further comprising:

defining a non-local coupling in which a boundary condition associated with said first domain is defined using a value of an integral over a portion of one of: said first domain and said second domain.

126.   (New) The method of Claim 118 , further comprising:

defining a non-local coupling using at least one of: a mapped variable and an integrated variable.

127.   (New) The method of Claim 121, further comprising:

defining a local coupling using at least one of: a basic variable, an auxiliary variable, and a glued variable.

128.   (New) The method of Claim 118 , further comprising:

defining a non-local coupling variable using at least one of: an extrusion variable, a projection variable, and a scalar coupling variable.

129.   (New) The method of Claim 118, further comprising:

determining a stiffness matrix by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak form, said stiffness matrix being a Jacobian matrix of a residual vector with respect to a number of degrees of freedom, said Jacobian of a variable being represented as at least one contribution determined in accordance

with a number of degrees of freedom; and

determining said residual vector by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak form.

130.   (New) The method of Claim 129, further comprising: converting said combined system of partial differential equations from general form to weak form.

131.   (New) The method of Claim 129, wherein said determining said stiffness matrix further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

132.   (New) The method of Claim 131, wherein said determining said residual vector further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

133.   (New) The method of Claim 118, further comprising: determining a value of a variable in accordance with a type of said variable used in at least one of said partial differential equation systems.

134.   (New) The method of Claim 133, wherein variables are recursively evaluated in accordance with variable type.

135.   (New) The method of Claim 134, wherein said determining a value of a variable in accordance with a type is used in determining at least one of a: stiffness matrix, constraint matrix, residual vector and a constraint residual vector.

136.   (New) The method of Claim 135, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated

variable.

137. (New) The method of Claim 118 , further comprising:

determining a Jacobian of a variable in accordance with a type of said variable used in at least one of said partial differential equations wherein said Jacobian of a variable is represented in accordance with a number of degrees of freedom.

138. (New) The method of Claim 137, wherein a Jacobian of a variable is recursively evaluated in accordance with variable type.

139. (New) The method of Claim 138, wherein said determining a Jacobian of a variable in accordance with a type is used in determining at least one of: a stiffness matrix, a residual vector, constraint residual vector, and a constraint matrix.

140. (New) The method of Claim 139, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

141. (New) The method of Claim 118, wherein said at least one non-local coupling includes a variable having a dependency on another variable at at least one distant point.

142. (New) The method of Claim 141, wherein said other variable is in the same geometry as said variable.

143. (New) The method of Claim 141, wherein said other variable is in a different geometry from said variable.

144. (New) The method of Claim 121, wherein said local coupling includes a variable having a dependency only on values of other variables at the same point.

145. (New) The method of Claim 118, further comprising:

defining a non-local coupling used in at least one of a: subdomain, boundary, edge, and point that obtains a value at one of: a subdomain, boundary, edge, and point.

146.   (New) The method of Claim 121, further comprising:

defining a local coupling using at least one of: an expression variable and a boundary coupled variable.

147.   (New) The method of Claim 118 , further comprising:

defining a non-local coupling wherein a value of an integral of a variable along parallel lines extending into a first domain is used on a boundary on said first domain.

148.   (New) The method of Claim 118, further comprising:

defining a boundary condition on one boundary in terms of a value of a variable on another boundary wherein said value is mapped in accordance with a coordinate transformation.

149.   (New) The method of Claim 118, further comprising:

defining a boundary condition in terms of a variable defined at a single point.

150 .   (New) A computer readable medium having computer executable instructions stored thereon which when executed by at least one processor cause the processor to accomplish steps comprising:

representing each of a plurality of systems as an application mode modeling physical quantities of said each system;

determining a representation of a partial differential equation system for each application mode corresponding to one of said plurality of systems using at least one non-local coupling, said at least one non-local coupling determining a value in at least one one portion of a domain depending on a value from at least one other portion of a domain; and

outputting a model by forming a combined system of partial

differential equations using partial differential equation systems associated with said plurality of systems.

151 . (New) The computer readable medium of Claim 150, wherein said non-local variable defines a value from a first domain in a first geometry to another domain in a second geometry.

152. (New) The computer-readable medium of Claim 151, further comprising:

forming, for each of said first and second geometries, a system of partial differential equations each having associated coupling variables.

153. (New) The computer readable medium of Claim 151 , wherein at least one of said partial differential equation systems uses at least one local coupling.

154. (New) The computer readable medium of Claim 151, wherein said first and second geometries are the same.

155. (New) The computer readable medium of Claim 151 , wherein said first and second geometries are different.

156. (New) The computer readable medium of Claim 150, further comprising:

defining a non-local coupling wherein a value of a quantity on a boundary of a first domain is referenced on parallel lines extending into said first domain.

157. (New) The computer readable medium of Claim 151, further comprising:

defining a non-local coupling in which a boundary condition associated with said first domain is defined using a value of an integral over a portion of one of said first domain and said second domain.

158. (New) The computer readable medium of Claim 150, further

comprising:

defining a non-local coupling using at least one of: a mapped variable and an integrated variable.

159.   (New) The computer readable medium of Claim 153, further comprising:

defining a local coupling using at least one of: a basic variable, an auxiliary variable, and a glued variable.

160.   (New) The computer readable medium of Claim 153, further comprising:

defining a non-local coupling variable using at least one of: an extrusion variable, a projection variable, and a scalar coupling variable.

161.   (New) The computer readable medium of Claim 150, further comprising:

determining a stiffness matrix by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak foam, said stiffness matrix being a Jacobian matrix of a residual vector with respect to a number of degrees of freedom, said Jacobian of a variable being represented as at least one contribution determined in accordance with a number of degrees of freedom; and

determining said residual vector by determining at least one of a Jacobian of a variable and a value of a variable in accordance with a type of said variable wherein said combined system of partial differential equations is in weak form.

162.   (New) The computer readable medium of Claim 161, further comprising:

converting said combined system of partial differential equations from general form to weak form.

163.   (New) The computer readable medium of Claim 161, wherein said determining said stiffness matrix further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

164.   (New) The computer readable medium of Claim 151, wherein said determining said residual vector further comprises:

determining at least one of a Jacobian of a variable and a value of a variable in accordance with points included in a quadrature formula and with other points in accordance with coupling variables.

165.   (New) The computer readable medium of Claim 150, further comprising:

determining a value of a variable in accordance with a type of said variable used in at least one of said partial differential equation systems.

166.   (New) The computer readable medium of Claim 165, wherein variables are recursively evaluated in accordance with variable type.

167.   (New) The computer readable medium of Claim 166, wherein said determining a value of a variable in accordance with a type is used determining at least one of a: stiffness matrix, constraint matrix, residual vector and a constraint residual vector.

168.   (New) The computer readable medium of Claim 167, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

169.   (New) The computer readable medium of Claim 150, further comprising:

determining a Jacobian of a variable in accordance with a type of said variable used in at least one of said partial differential equations wherein said Jacobian of a variable is represented in accordance with a number of degrees of freedom.

170.   (New) The computer readable medium of Claim 169, wherein a

Jacobian of a variable is recursively evaluated in accordance with variable type.

171.   (New) The computer readable medium of Claim 169, wherein said determining a Jacobian of a variable in accordance with a type is used in determining at least one of: a stiffness matrix, a residual vector, constraint residual vector, and a constraint matrix.

172.   (New) The computer readable medium of Claim 171, wherein said type is one of: a basic variable, an auxiliary variable, a glued variable, a mapped variable, and an integrated variable.

173.   (New) The computer readable medium of Claim 157, wherein said at least one non-local coupling includes a variable having a dependency on another variable at at least one distant point.

174.   (New) The computer readable medium of Claim 173, wherein said another variable is in the same geometry as said variable.

175.   (New) The computer readable medium of Claim 173, wherein said other variable is in a different geometry from said variable.

176.   (New) The computer readable medium of Claim 159, wherein said local coupling includes a variable having a dependency only on values of other variables at the same point.

177.   (New) The computer readable medium of Claim 157, further comprising:

defining a non-local coupling used in at least one of a: subdomain, boundary, edge, and point that obtains a value at one of: a subdomain, boundary, edge, and point.

178.   (New) The computer 0readable medium of Claim 159, further comprising:

defining a local coupling using at least one of: an expression variable

and a boundary coupled variable.

179.   (New) The computer readable medium of Claim 151, further comprising:

defining a non-local coupling wherein a value of an integral of a variable along parallel lines extending into a first domain is used on a boundary on said first domain.

180.   (New) The computer readable medium of Claim 157, further comprising:

defining a boundary condition on one boundary in terms of a value of a variable on another boundary wherein said value is mapped in accordance with a coordinate transformation.

181.   (New) The computer readable medium of Claim 151, further comprising:

defining a boundary condition in terms of a variable defined at a single point.